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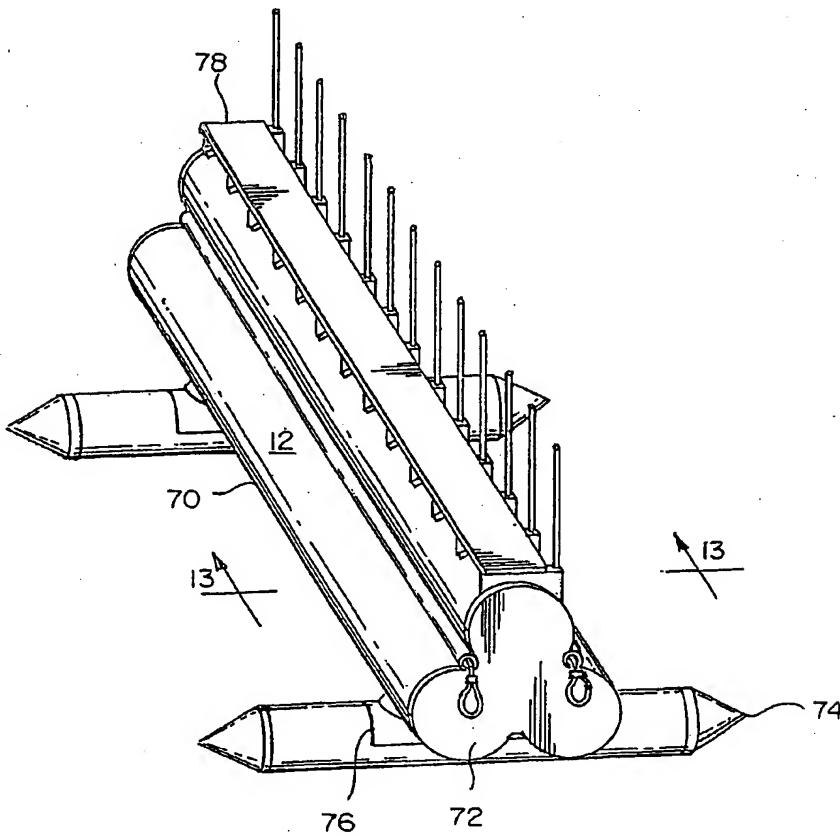
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*[Continued on next page]*

(54) Title: SECURITY BARRIER UNIT



(57) Abstract: Barrier units for use in constructing barriers and a method for constructing the barrier units are disclosed. The barrier units are suitable for a variety of purposes including the construction of security barriers for sensitive facilities or temporarily halted ships. The barrier units of this invention can also be used as buffers between marine vessels or between marine vessels and harbor facilities to prevent damage to vessels. The barrier units of this invention can include vertical uprights, vertical protective mesh, submarine protective mesh, impalement spikes, walkways, and internal compartments for storage or occupation by security personnel. The security barrier can include lights or other electronic devices for providing security. The barrier units can be used to provide security for land-based facilities and for barriers between lanes of traffic.



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## Security Barrier Unit

## FIELD OF INVENTION

This invention relates to barriers suitable for use in marine environments. In particular, this invention describes structurally integrated barrier units, which can be used for a multitude of purposes, both on land and in the water.

## BACKGROUND OF THE INVENTION

Warships are quite capable of defending themselves from attack by recognized foes on the open ocean. They are equally capable of identifying and defending themselves from attacks by terrorists on the open ocean. However, once a warship is in a harbor, for refueling or repairs, it becomes more vulnerable to surprise attack by terrorists or commando units.

The level of activity in most harbors makes detection and recognition of attack much more difficult. Additionally the close confines of some harbors and the proximity of noncombatants make the defensive use of many weapons systems organic to the warships impractical, if not impossible, during a terrorist attack or commando raid. Commercial vessels that may be carrying material of national importance are also vulnerable to such attacks while they are in a harbor.

Some marine facilities are also vulnerable to attacks by small groups of terrorists or commandos. A terrorist attack or commando raid on locks or dams could potentially have catastrophic results. Similarly, such raids on temporary or permanent repair facilities, refueling facilities, or load/unload facilities have the potential to adversely affect national security.

One way to protect temporarily halted vessels or sensitive marine facilities would be to erect some kind of security barrier so that reaching the vessel or facility would be more

difficult. While the erection of a barrier on land may be relatively simple, the erection of such a barrier in a marine environment is more difficult. In addition to being costly, a permanent barrier in a marine environment has the potential to become an inconvenience or even a safety hazard once it is no longer needed. Therefore, security barriers that could be used in a marine environment when needed and stored at an out of the way location when not needed are desired. Such security barriers that are lightweight and easily portable would be very advantageous.

Several methods exist in the prior art for protecting vessels from attack on the open sea. One such method is described in U. S. Patent No. 4,961,393, issued to Murray. The Murray patent describes the use of an articulated train of floating projectile barriers that are made of metal and towed behind a ship. To defense on attack, the ship circles away from the attacker to a position behind a trailing portion of the floating barrier train. To provide defense against torpedo attacks, the barriers of the Murray patent have metal keels that extend at least as deep as the keel of the ship to be protected. In addition to being heavy, and therefore not very portable, the metal barriers used in the Murray patent are not very practical for static defense in a harbor type marine environment where water depth at the desired location for a barrier placement might not be as deep as the keel of the ship to be protected.

Other, barrier type, devices also exist in the prior art, but they are used primarily for breakwaters. One such device is described in U. S. Patent No. 3,952,521, issued to Potter. The Potter patent discloses a floating breakwater supported by pontoons or floats. A similar device is described in U. S. Patent No. 4,715,744, issued to Richey, which discloses a floating breakwater constructed from steel. Yet another device is described in U. S. Patent No. 5,215,027, issued to Baxter, which discloses a concrete flotation module that is adapted for use as a floating dock or breakwater. None of these breakwater devices is readily adaptable for use as a security barrier in that a swimmer could easily go under each of them.

It is possible that a small boat could build up enough speed to jump over the devices disclosed in the Potter and Baxter patents. Additionally, the device described in the Richey patent would be heavy and difficult to move.

In addition to marine areas, there is often a need to provide a security perimeter around structures or areas on land, such as airports. While earthen berms are suitable for providing security for these areas, it is often impractical or impossible to construct such berms. Other types of security barriers such as the fence described in U.S. Patent No. 5,556,080, issued to Vise, are not easily movable once installed.

Therefore, a need exists for a relatively lightweight and portable device that can be used to provide a security barrier for sensitive facilities and temporarily halted warships. Such a device should provide security from attacks by terrorists or commandos. Such a device that would be inexpensive to produce, and be readily adaptable for a variety of other uses would be particularly advantageous.

#### SUMMARY OF THE INVENTION

It is an object of this invention to provide a structurally integrated relatively lightweight and portable barrier suitable for a variety of uses.

Another object of this invention is to provide such a barrier that is relatively inexpensive to produce.

A further object of this invention is to provide a method for making such barriers in a variety of shapes and sizes.

These and other objects of the invention will become more readily apparent from the disclosure herein when taken in conjunction with the appended claims.

The present invention is directed to providing barrier units that are adaptable for a variety of uses, and a method for making such barrier units. Embodiments of this invention could be used to protect sensitive facilities and temporarily halted ships or they could be used

as a buffer between marine vessels. Other embodiments can be used on land as a fence or security barrier. The barrier units of this invention can also be used to provide a barrier between lanes of traffic on highways and roadways.

The present invention provides barrier units constructed from a plurality of tubular members arrayed such that each member is engaged and supported by at least two adjacent tubular members. The barrier units of the invention can be constructed in a variety of shapes. In some embodiments the tubular members are placed on pontoons that are oriented at a right angle to the tubular members.

Barrier units of this invention can be constructed such that the ends of the tubular members are capped, thereby providing buoyancy. The tubular members of some embodiments can be filled with buoyant material to ensure that they will float if the outer shell of the tubular member is punctured, while in other embodiments the tubular members may be filled with water or other material to provide stability or weight. Additionally, in at least one preferred embodiment of the invention, tubular members are fitted with a valve for inserting or removing air from one end of the capped tubular members and a valve for inserting or removing liquid on the end opposite the air valve.

The barrier units of this invention are preferably constructed from a plurality of tubular members laid side by side and structurally adhered together with adhesives, straps, bands, or any other suitable manner.

Impalement spikes are provided on some embodiments of the invention to prevent personnel or small water craft from running up the front of the barrier. In some embodiments, vertical uprights and vertical protection mesh are also provided to prevent small water craft from running up the front of and over the barrier.

Various embodiments of this invention further may provide a submarine protective mesh to prevent swimmers, scuba divers, and small submarine vessels from going under the

barrier. At least one embodiment of this invention also provides access to the interior portion of the barrier unit so that personnel may have concealed access and electronic equipment such as radar, sonar, or lights can be installed on the barrier.

The barrier units of this invention are capable of being transported by aircraft, ship, truck, or train. Some of the various shapes of barrier units can be constructed to provide open compartments for equipment storage or for occupation by security personnel. The barrier units of this invention can also be constructed with angled ends to more easily facilitate building corners into a security barrier.

To construct a security barrier using the barrier units of the current invention one must first determine the shape and length of the area to be secured, and the types of barrier units needed. An appropriate number of barrier units are then moved into place, the barrier units are then connected to each other and secured so that they will remain in position. If desired, the vertical protective mesh and submarine protective mesh (for marine environments) can then be installed, or deployed if already installed on the barrier units. Depending on the embodiment of barrier units used, the barrier can be occupied by security personnel or left unoccupied.

One example of how the current invention could be used in a marine environment is for the security of deployed warships that must undergo emergency repairs. If a warship suffered mechanical difficulties or other types of damage, it could proceed to the nearest convenient port. The size of the barrier needs to provide security while the ship underwent repairs could then be determined, and an appropriate number of barrier units could then be transported to the location of the warship. The security barrier could then be assembled and left in place while repairs were underway. Once repairs were completed, the security barrier could be disassembled and the barrier units could be transported back to the storage location.

To support this type of use, the barrier units of this invention could be pre-deployed to staging areas around the globe.

In another example, the barrier of this invention could be used to provide security for a sensitive land-based facility. In this example, the size and shape of the security barrier would be calculated in the same way as if the barrier were being placed in a marine area. The barrier units would be placed around the facility to be secured, and they could be anchored to the ground with stakes if required. When deployed in this manner, the barrier units not only assist in keeping unauthorized people away from the secured area, but they also prevent casual observers from seeing any activity conducted behind the barrier. Vertically disposed fencing or netting may be used to extend the effective vertical height of the barrier.

The current invention provides a relatively lightweight and portable security barrier suitable for a variety of uses. The barrier of this invention can be used to provide security for sensitive facilities and temporarily halted ships against attacks by terrorists or commandos. When used in this manner, the barrier units of this invention can be pre-deployed to staging areas and transported to an area to be secured as needed. Additionally, the barrier units of this invention can be used as buffers between marine vessels to prevent the vessels from contacting each other and causing damage.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The several objectives and features of the present invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective top view of a security barrier, constructed from the barrier units of this invention, used to secure a warship.

FIG. 2 is a perspective view of the front side of one embodiment of a security barrier of this invention that is in the form of an equilateral triangle with impalement spikes and vertical protective mesh attached to the top of the barrier unit.

FIG. 3 is a perspective view of the rear side of the embodiment depicted in FIG. 2.

FIG. 4 is a cross-sectional end view taken along line 4 - 4 in FIG. 2, showing the tubular members of the barrier unit filled with buoyant material.

FIG. 5 is a cutaway end view of one of the tubular members in FIG. 4 showing the impalement spike in more detail.

FIG. 6 is a perspective view of another embodiment of a barrier unit of the invention with compartments open to the rear side for storage of equipment or for occupation by security personnel.

FIG. 7 is a cross-sectional end view taken along line 7 - 7 of FIG. 6 showing the tubular members on the base, the front side and the top of the barrier unit in FIG. 6 filled with buoyant material.

FIG. 8 is a cross-sectional end view of a barrier unit of the invention in the shape of an isosceles trapezoid, with a walkway on the top of the barrier unit.

FIG. 9 is a cross-sectional end view of another embodiment of the invention in the form of an equilateral triangle with three extra tubular members attached to the rear side of the barrier unit to support a cantilevered walkway. The embodiment in FIG. 9 also shows a flat sheet of low friction material attached to the front of the barrier unit to impede someone from scaling the barrier, and a submarine protective mesh attached to the base of the barrier unit.

FIG. 10 is an overhead view of two barrier units of this invention connected to each other, and anchored in place.

FIG. 11 is a cross-sectional end view of another embodiment of this invention in the shape of a square.

FIG. 12 is a perspective view of another embodiment of a barrier unit of the invention that utilizes pontoons.

FIG. 13 is a cross-sectional end view of the barrier unit shown in Fig. 9.

Fig. 14 is a cross-sectional end view of the barrier unit shown in Fig. 9.

Fig. 15 is a cross-sectional end view of another embodiment of a barrier unit of the invention.

#### BEST MODE OF CARRYING OUT THE INVENTION

Turning now to the drawings, the invention will be described in preferred embodiments by reference to the numerals of the drawing wherein like numbers indicate like parts. FIG. 1 depicts a security barrier 1, constructed from a plurality of barrier units of the current invention deployed around a warship 5. The preferred embodiment of barrier units for this use are designed and constructed such that they will float on the surface of the water. The barrier units of this invention are connected to each other to form the security barrier. The space between the barrier units is small enough to prevent small water craft and swimmers from going between the barriers. Bumpers (not shown) may be employed to keep the barrier units from bumping each other due to wave action.

FIG. 2 shows the front side of one preferred embodiment of a barrier unit 10 of the current invention, and FIG. 3 shows the rear side of the same barrier unit 10. The barrier unit 10 is comprised of tubular members 12 that are arranged so that barrier unit 10 is in the shape of an equilateral triangle.

The ends of the tubular members 12 can be sealed to provide buoyancy. Tubular members 12 can further be filled with buoyant material so that the barrier unit 10 will continue to float should the outer skin of a tubular member 12 be punctured. To conveniently

form barrier arrays which surround an object to be protected, the ends of some of the barrier limits may be angled.

Also seen in Figs. 2 and 3 are vertical uprights 15, and vertical protective mesh or fencing 17. The vertical uprights 15 are attached to the top of the barrier unit 10 and can be fitted with lights or other electronic devices (not shown) to assist in security. When such electronic security measures are used, or for other reasons, at least one of the tubular members 12 may be equipped with a watertight hatch (not shown) that allows access to the interior of the tubular member. The interior of the tubular member is configured so electronic instruments and other devices and supplies can be installed or stored securely inside the tubular member.

Vertical protective mesh 17 is attached to vertical uprights 15. The mesh 17 can be barbed fencing, cargo netting, radar and sonar deflector or some other material. The purpose of the mesh 17 is to prevent small water craft from riding up and over the front of the barrier unit 10 and to capture or deflect missiles or other objects.

FIG. 4 is a cross sectional view of the end of the barrier unit 10 taken along line 4 – 4 of FIG. 2. Impalement spikes 19 are included on this embodiment. The impalement spikes 19 help to prevent small water craft from riding up and over the front of barrier unit 10. The impalement spikes 19 also assist in deterring people from attempting to scale barrier unit 10. The impalement spikes 19 are preferably made from a hard resin material, but they can be made from any hard material. The impalement spikes 19 are preferably about four inches long but can be shorter or longer as desired.

The impalement spikes 19 can be attached directly into apertures in the front of the barrier unit 10. Another method for attaching the impalement spikes 19 is to adhesively attach a saddle (not shown), which conforms to the shape of the barrier unit 10 and is placed on the front of the barrier unit 10. The impalement spikes 19 can be attached so that they face

straight out, or so that they angle downward.

FIG. 5 is an isolated end view of one of the tubular members 12 shown in FIG. 4. FIG. 5 shows that tubular member 12 is filled with buoyant material 21 so that the barrier unit 10 will continue to float if the outer shell of the tubular member 12 is punctured. The buoyant material 21 is preferably a closed cell rigid foam that has been injected into the tubular member, but any material that will retain a high degree of buoyancy while wet is suitable.

FIG. 5 also shows implement spike 19 in more detail. The spikes are sharpened, and can be attached to the barrier unit 10 by using saddles as described above, or they can be attached directly to the barrier unit 10 using adhesives or other suitable fastening means.

FIG. 6 shows the rear side of another preferred embodiment of a barrier unit for this invention. The barrier unit 25 is constructed using long tubular members 12 for the front side, the top, and the base of the barrier unit 25. The rest of the barrier unit is constructed using tubular members 27 that are substantially shorter than those used on the front side, top, and base. In the embodiment depicted in FIG. 6, the short tubular members 27 are stacked at the ends and in the middle of the barrier unit 25 so that two compartments are formed in the barrier unit 25. These compartments are open on the rear side of the barrier unit 25, and they can be used for equipment storage or they can be occupied by security personnel. In some embodiments, firing or observation ports (not shown) can be created by the addition of a hole that communicates through at least one of the tubular members 12 on the front side of the barrier unit 25. For barrier units used in marine environments, the holes for the firing ports would need to be watertight. In another embodiment (not shown) the shorter tubular members 27 are stacked only on the ends so as to create only one compartment in the barrier unit.

FIG. 7 is a cross sectional view taken along line 7 – 7 of FIG. 6. In the embodiment

depicted, the tubular members 12 that are used for the front, top and base of barrier unit 25 are filled with buoyant material 21. Short tubular members 27 are not filled with buoyant material 21 in this FIG., but the ends of the tubular members 27 are sealed so that they are buoyant. In other embodiments, short tubular members 27 can also be filled with buoyant material. The barrier unit 25 depicted in Figs. 5 and 7 also has vertical uprights 15 and vertical protective mesh 17. These elements fulfill the same function as they do on other embodiments.

FIG. 8 is a cross-sectional end view of another preferred embodiment of a barrier unit of the invention. Barrier unit 30 is in the shape of an isosceles trapezoid, and walkway 32 is added. Walkway 32 runs the length of the barrier unit 30 along the top of the barrier unit 30.

FIG. 9 is an end view of yet another preferred embodiment of a barrier unit of the invention. Barrier unit 40 is essentially a triangular shaped barrier unit with three extra tubular members 41 on the rear side of the triangle. Walkway 42 is supported by tubular members 41 and by brace 43. In other embodiments, walkway 42 can be attached directly to the barrier unit and solely supported by brace 43.

A sheet of low friction material 44 is attached to the front side of the barrier unit 40 to make it extremely difficult for swimmers to scale the front of the barrier unit 40. While not depicted in this FIG., impalement spikes can be attached to the front of the low friction material 44. Additionally, material designed to stop or impede bullet penetration can be attached to all of the various embodiments of barrier units of this invention in a manner similar to the attachment of the low friction material 44. Additionally, the barrier unit can be constructed in a pressurized autoclave where a film or layer of bullet impeding material, or other desired material, can be pressure formed to the shape of the barrier unit and bonded to the surface of the barrier unit during the heating process.

Also shown in FIG. 9 is submarine protective mesh 46, which is used to prevent or

deter swimmers, scuba divers, and small submarine vessels from going under the barrier. During transportation, mesh 46 can be detached from the barrier unit 40 and reattached once the barrier unit is deployed. Mesh 46 can also be rolled up and secured to the barrier unit 40 during transportation and then lowered into position using rope 47 once the barrier unit is in position. The mesh 46 can be attached to anchor 50 once the barrier unit 40 is in position or smaller anchors can be permanently attached to the mesh 46.

FIG. 10 shows two triangular shaped barrier units 10 anchored in position using anchor lines 52 connected to the barrier units 10 and anchor 50. Coupler 57 is used to attach the barrier units 10 to each other, but other suitable fastening means could be used. Instead of using anchors 50, barrier units 10 could be fastened to pilings (not shown) using means that would allow the barrier units to rise and fall with waves and tidal changes.

FIG. 11 is an end view of another embodiment of a barrier unit of the invention in the shape of a square. This barrier unit 60 is assembled in the same manner as the other embodiments of barrier units of this invention.

FIG. 12 depicts another preferred embodiment of a barrier unit of the invention. Barrier unit 70 is essentially a triangular shaped barrier unit. In the preferred embodiment depicted, a single cap is used to cover the ends of all tubular members. The barrier unit 70 rests on pontoons 74. A saddle 76 is connected to the pontoons 74 and the bottom row of tubular members are connected to the saddle.

FIG. 13 is an end view of the barrier unit depicted in FIG. 12 further showing additional tubular members 78. Ropes or cables can be routed through the additional tubular members and attached to the anchor points at the end of the barrier unit.

FIG. 14 is an end view of another barrier unit of the type depicted in FIG. 12. Tubular members are arrayed to form an equilateral triangle. Additional tubular members 88 are attached to the barrier unit and ropes or cables can be routed through the additional

tubular members. The bottom row of tubular members are connected to saddles 86 that are secured to pontoons 84. Another example of the use of the current invention would be for securing a sensitive marine facility such as a refueling point for warships or a cargo offloading point in a potentially hostile area. A security barrier of the current invention could be built to provide security for the facility. A number of barrier units could be releasably anchored or left unanchored so that a barrier unit could be disconnected from the security barrier to permit ingress and egress to and from the secure area.

The disconnected barrier unit could then be towed away from the security barrier allowing the unanchored barrier units to swing away from the security barrier like a gate. Ships could then go into or exit the protected area, and the disconnected barrier unit would then be reconnected to the security barrier unit effectively closing the gate. Other embodiments of barrier units could be used as buffers to prevent the ships from contacting the refueling facility or docks. The invention also functions as a floating breakwater to protect objects inside the barrier array. Pollution control methods and devices can be readily used in conjunction with the barrier array of this invention.

FIG. 15 depicts a cross sectional view of another preferred embodiment of the current invention that can be used as a barrier on land. One potential use for this embodiment is use as a barrier between lanes of traffic. However, there are many other potential uses. The barrier unit 90 is constructed from a plurality of tubular members having different diameters. The tubular members are connected to each other in same manner as described above. The support member 96 can be secured to the surface upon which the barrier unit rests by using adhesive, stakes, or other mechanical fastening devices. The support member can be secured to the barrier unit by adhesive or any suitable mechanical fastening device, or the barrier unit can simply rest on the support unit without being secured to it. The tubular members of this

embodiment can have capped ends, and they can be filled with water or other material to provide stability.

One example of use for the embodiment depicted in FIG. 15 would be as a replacement for jersey barriers commonly found on major highways. For this use, the support member would be secured to the surface of the roadway, and some or all of the barrier units could be filled with water or other desired material either before the barrier units are positioned or after they are in their desired location. The barrier units could be connected to each other in a manner similar to that seen in FIG. 10.

The tubular members of this invention are constructed from fiber reinforced elastomers and fiber re-enforced polymers. In at least one preferred embodiment of this invention, the tubular members are constructed from filament wound fiberglass using epoxy resins. However, the tubular members of this invention can be constructed from any type of suitable material.

The lengths of the barrier units of this invention are based on the use for the particular units, and lengths between 15 and 80 feet are envisioned. In at least one preferred embodiment, the barrier unit is 40 feet long.

The diameter of the tubular members of this invention vary from 6 inches up to 48 inches. In at least one preferred embodiment of the invention, the tubular members have a 24 inch diameter.

The current invention provides easily transportable barrier units suitable for a variety of uses. Barrier units of this invention can be pre-deployed to staging areas around the world and transported by ship, truck, train, or aircraft to another area when needed. Barriers can be constructed from these barrier units to provide security for sensitive facilities and temporarily halted ships. The barrier units of this invention can also be used as buffers between marine vessels or between vessels and port facilities.

## INDUSTRIAL APPLICABILITY

The invention has applicability to the field of security, in particular, this invention describes barrier units that can be used to create a barrier to provide security for temporarily halted ships, and sensitive facilities. The invention also has applicability in the field of shipping, in particular, this invention describes barrier units that can be placed between marine vessels or between a vessel and a harbor facility to prevent damage caused by contact. Additionally, the invention has applicability in the fields of construction, transportation and other fields not specifically referenced herein in that it provides barrier units that are suitable for performing a plurality of tasks. The barrier units of this invention are easily transportable and can be pre-deployed to staging areas so that they will be readily available when needed.

In compliance with the statute, the invention has been described in language more or less specific as to structural features. It is to be understood, however, that the invention is not limited to the specific features shown or described, since the means and construction shown or described comprise preferred forms of putting the invention into effect. Additionally, while this invention is described in terms of being used to provide a security barrier for temporarily halted ships and sensitive facilities or as a buffer to prevent damage to marine vessels, it will be readily apparent to those skilled in the art that the invention can be adapted to other uses as well. The invention should not be construed as being limited to barrier units for security or damage prevention and is therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims, appropriately interpreted in accordance with the doctrine of equivalents.

## CLAIMS

What is claimed is:

1. A barrier unit for use in constructing a barrier comprising a plurality of tubular members;  
said tubular members comprising an outer shell, and a longitudinal channel therethrough;  
said tubular members being stacked in an array with each of said tubular members engaging and supported by adjacent tubular members;  
thereby forming a unified structure with a top, a base, a front side, and a rear side.
2. The barrier unit of claim 1 wherein each of said tubular members is bonded along its length to adjacent of said tubular members.
3. The barrier unit of claim 1 wherein said unified structure is in the shape of an equilateral triangle and said top of said unified structure is the apex of said triangle.
4. The barrier unit of claim 1 wherein said unified structure is in the shape of an isosceles trapezoid and said top of said unified structure is the top base of said trapezoid.
5. The barrier unit of claim 1 wherein said unified structure is in the shape of an isosceles trapezoid and said top of said unified structure is the top base of said trapezoid.
6. The barrier unit of claim 1 further comprising a plurality of impalement spikes attached to said barrier unit.

7. The barrier unit of claim 6 further comprising attachment saddles for attaching said impalement spikes.
8. The barrier unit of claim 1 wherein the ends of at least one of said tubular members are sealed.
9. The barrier unit of claim 8 wherein said at least one tubular member is filled with a buoyant material so that said at least one tubular member will remain buoyant if said outer shell is penetrated.
10. The barrier unit of claim 8 wherein at least one of said tubular members further comprises a watertight hatch that allows access to said longitudinal channel of said at least one tubular member.
11. The barrier unit of claim 10 wherein said at least one tubular member further comprises electronic instruments installed in said longitudinal channel.
12. The barrier unit of claim 8 further comprising a valve at each end of said tubular member.
13. The barrier unit of claim 8 wherein said tubular member is filled with water.

14. The barrier unit of claim 1 wherein said tubular members that form said top, said base and said front side of said unified structure are all the same length and the remainder of said tubular members are substantially shorter than the length of said tubular members that form said top, said base and said front side of said unified structure;

whereby when said tubular members are stacked to form said unified structure, said barrier unit has at least one compartment therein, and said at least one compartment is open on said rear side of said unified structure of said barrier unit for access by operating personnel and equipment.

15. The barrier unit of Claim 1 further comprising a connection device at each end for connection said barrier unit to other barrier units and for connecting said barrier unit to anchors.

16. The barrier unit of claim 3 further comprising at least two pontoons, at least two saddles, and a plurality of rope insertion members;

said rope insertion members being an elongated member with a longitudinal channel therethrough;

said rope insertion members being connected to said barrier unit such that they are part of said unified structure of said barrier unit;

whereby said saddles are attached to said pontoons; and the base of said barrier unit is attached to said saddles.

17. A barrier unit for use in constructing a barrier comprising a plurality of tubular members;

at least two pontoons;

at least two saddles;

said tubular members comprising an outer shell, and a longitudinal channel therethrough; said tubular members being stacked in an array with each of said tubular members engaging and supported by adjacent tubular members; thereby forming a unified structure with a top, a base, a front side, and a rear side;

said pontoons comprising a tubular member having conical ends;

whereby said saddles are attached to said pontoons; and the base of said unified structure is attached to said saddles.

18. A barrier unit for use in constructing a barrier comprising: a plurality of tubular members, and a support member:

said tubular members comprising an outer shell, and a longitudinal channel therethrough;

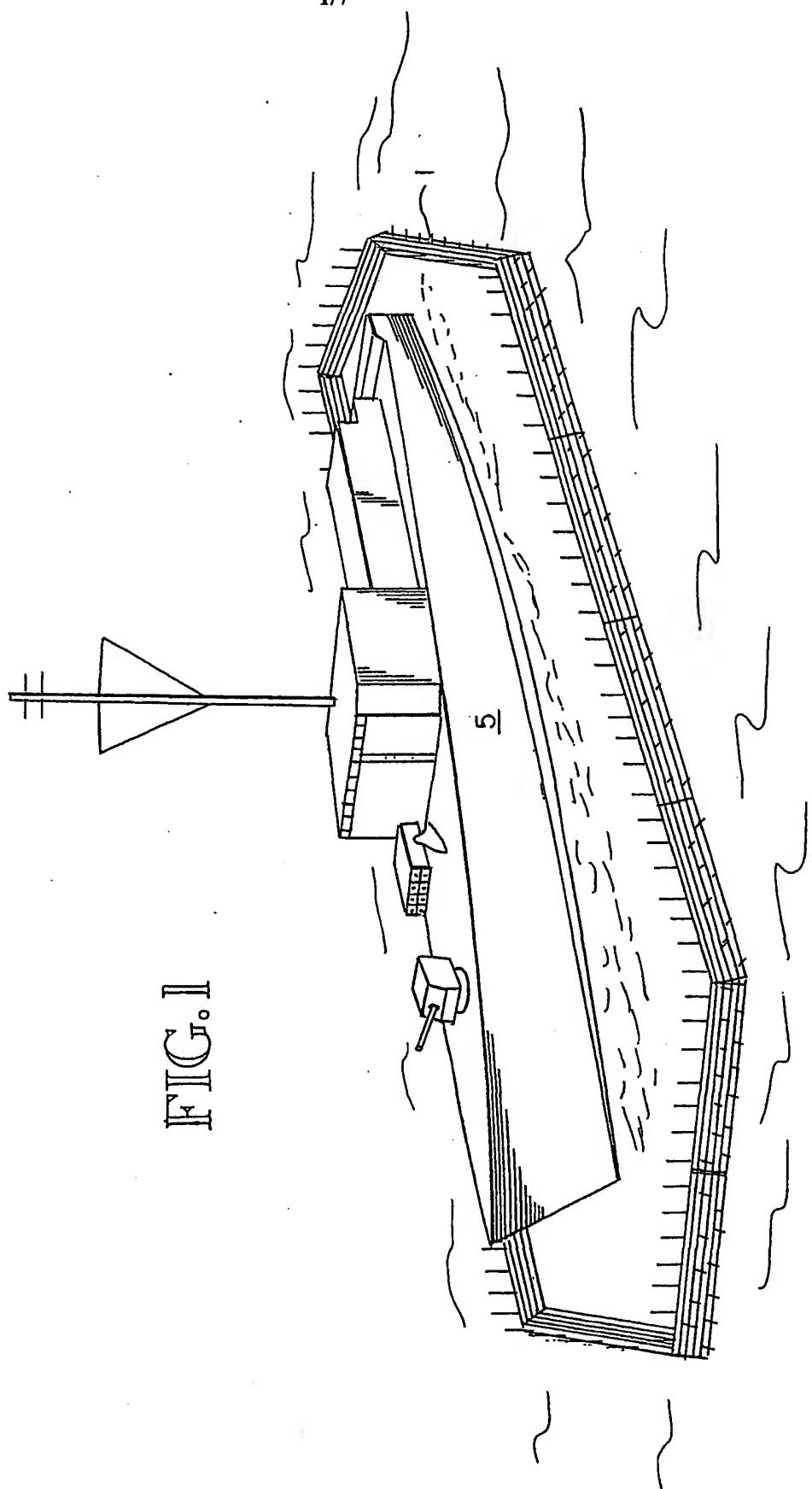
said tubular members being stacked in an array with each of said tubular members engaging and supported by adjacent tubular members;

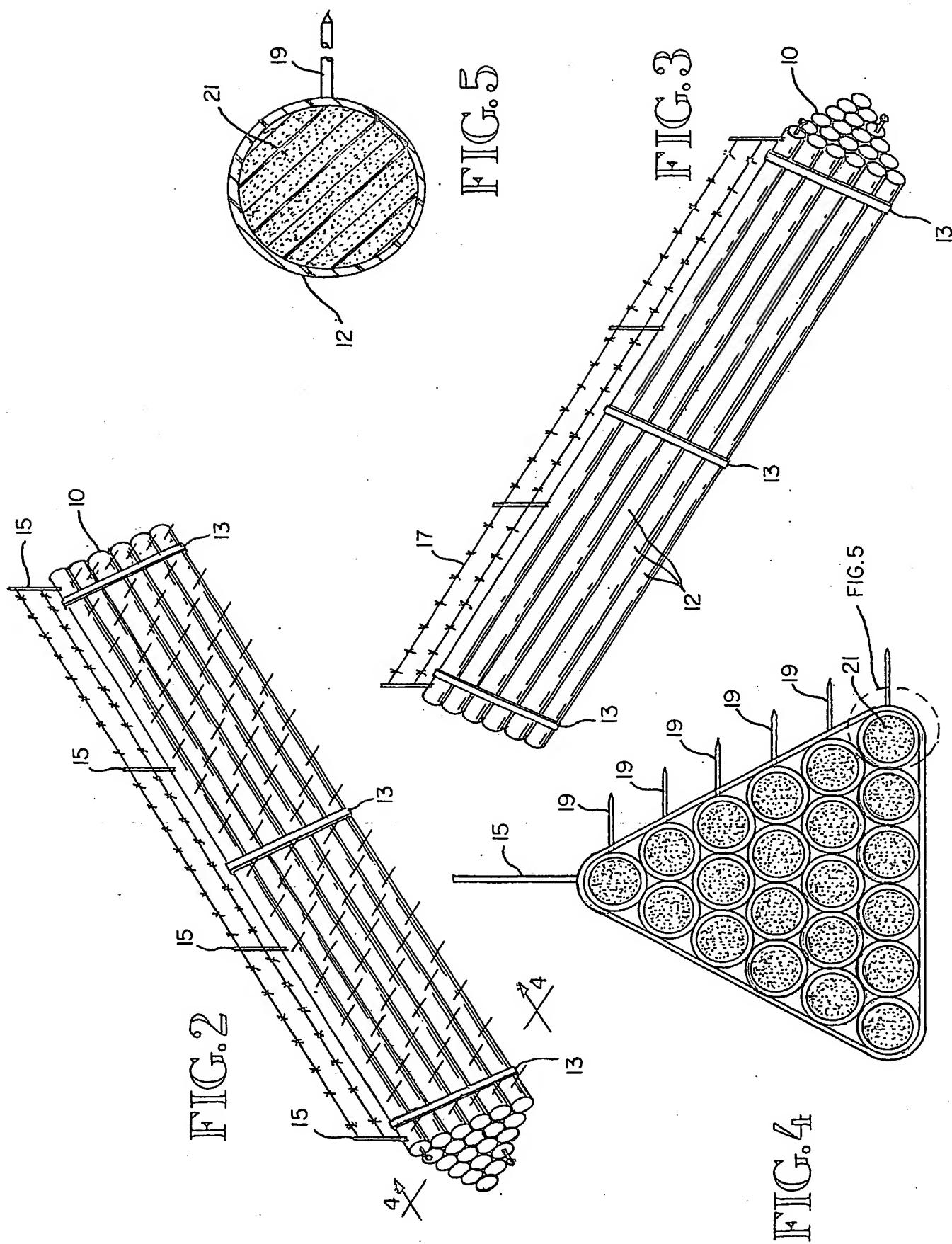
thereby forming a unified structure with a top, a base, and two sides; and

the base of said unified structure being connected to said support member.

19. The barrier unit of claim 18 wherein the ends of at least one of said tubular members are sealed.

20. The barrier unit of claim 19 wherein said tubular member is filled with water.





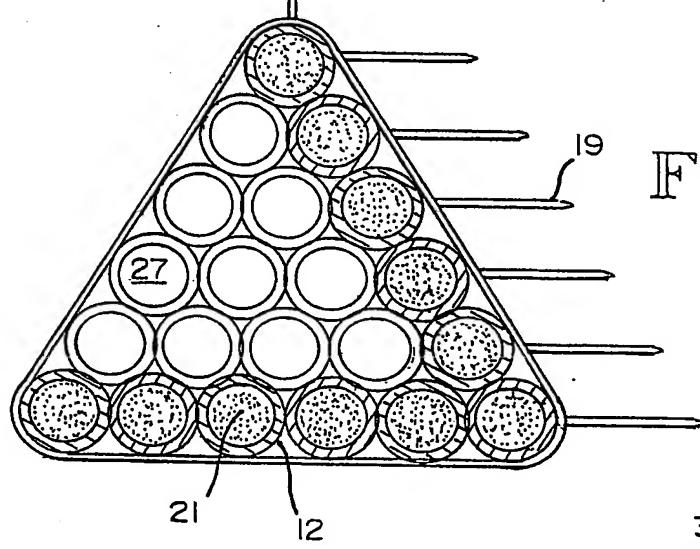
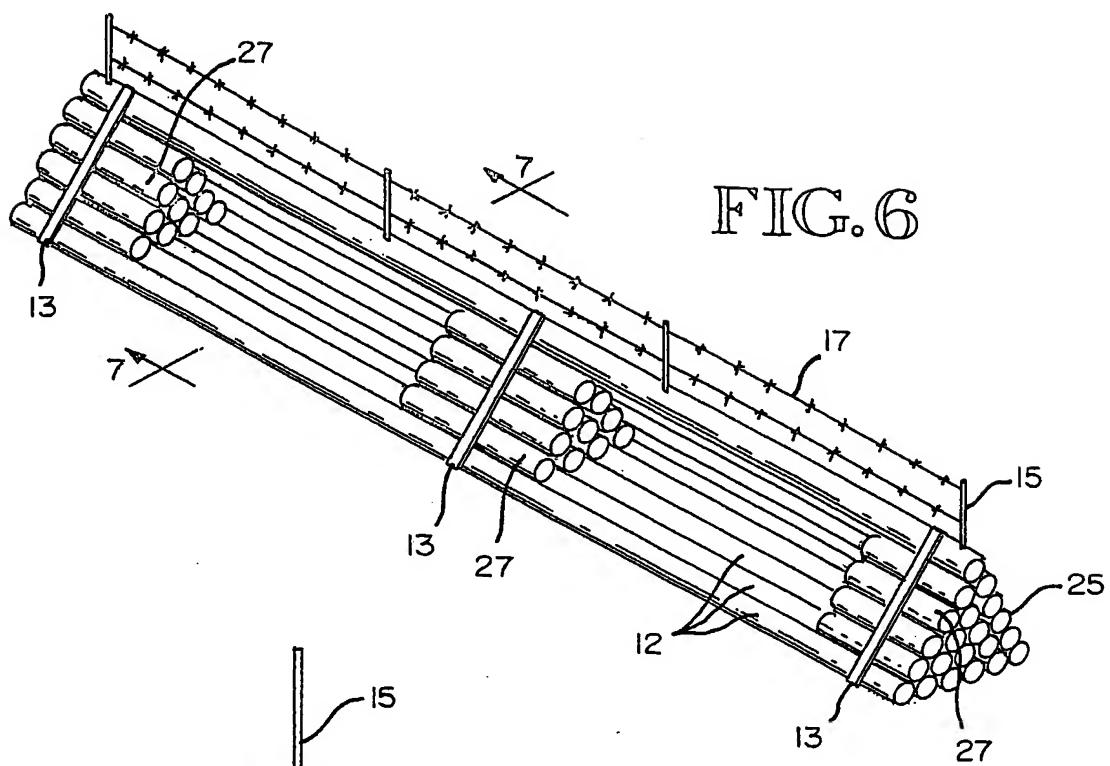
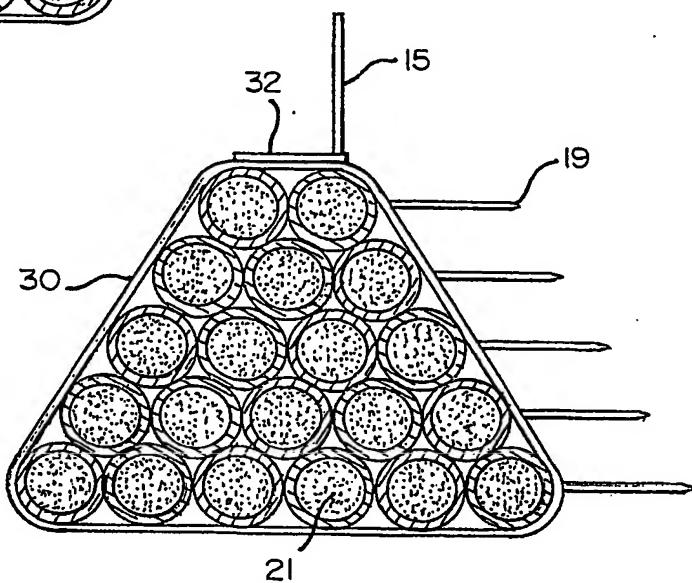
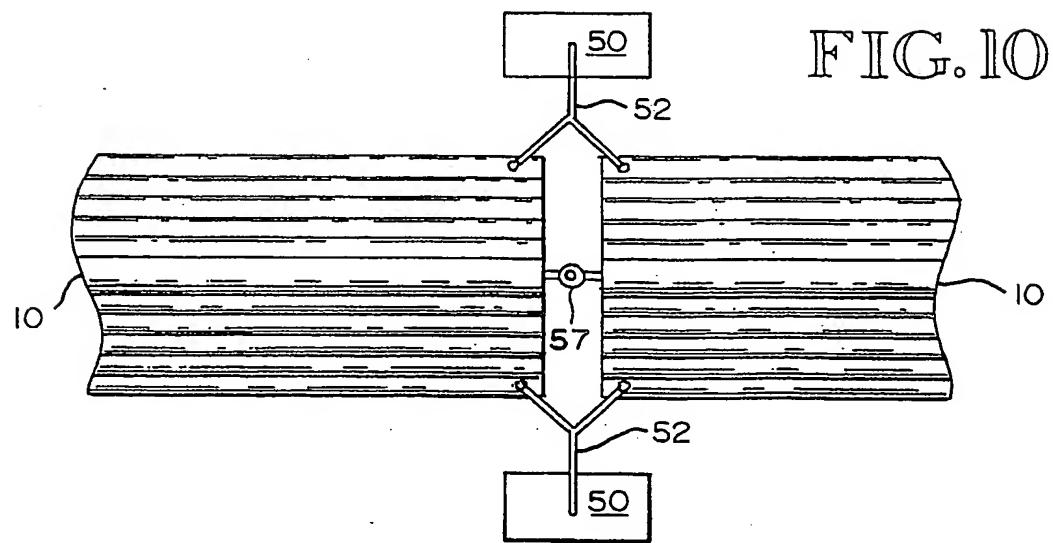
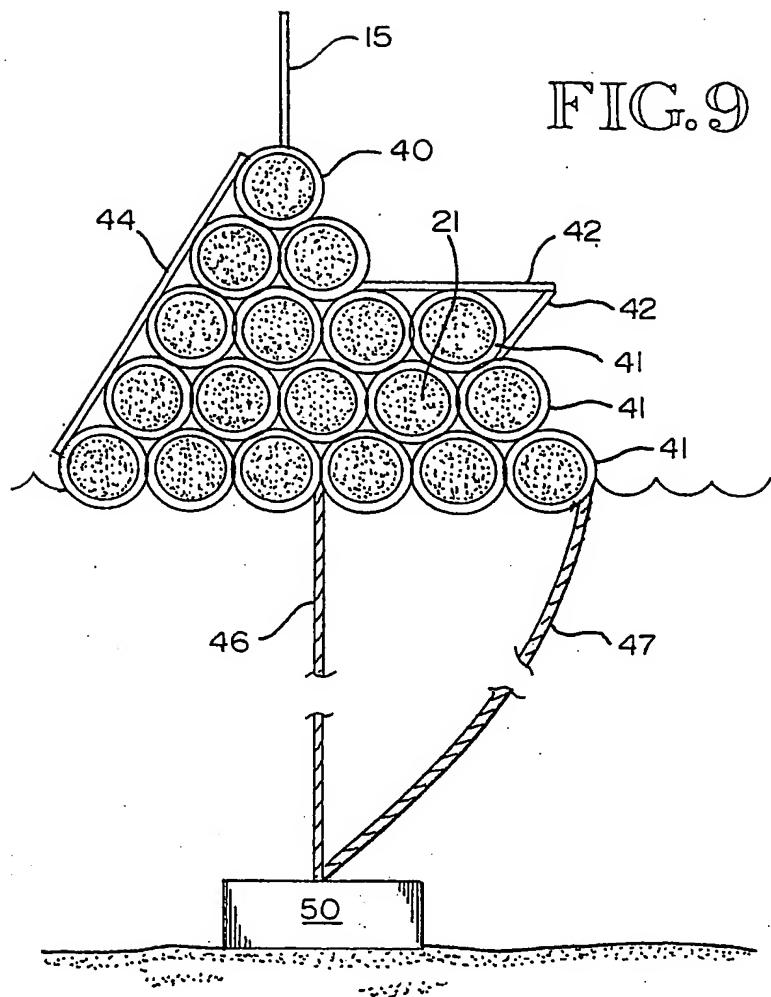


FIG. 8





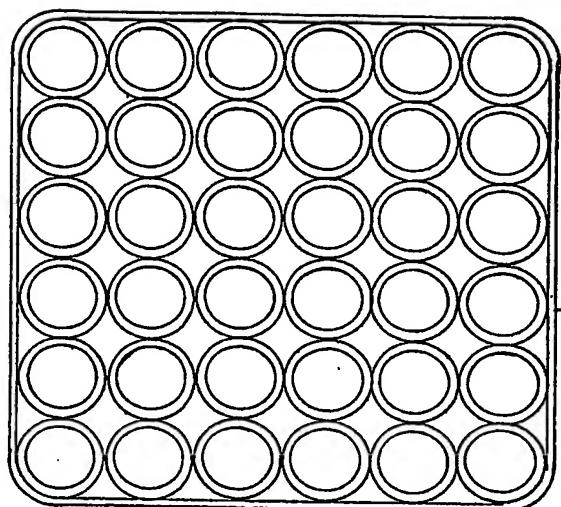


FIG. 11

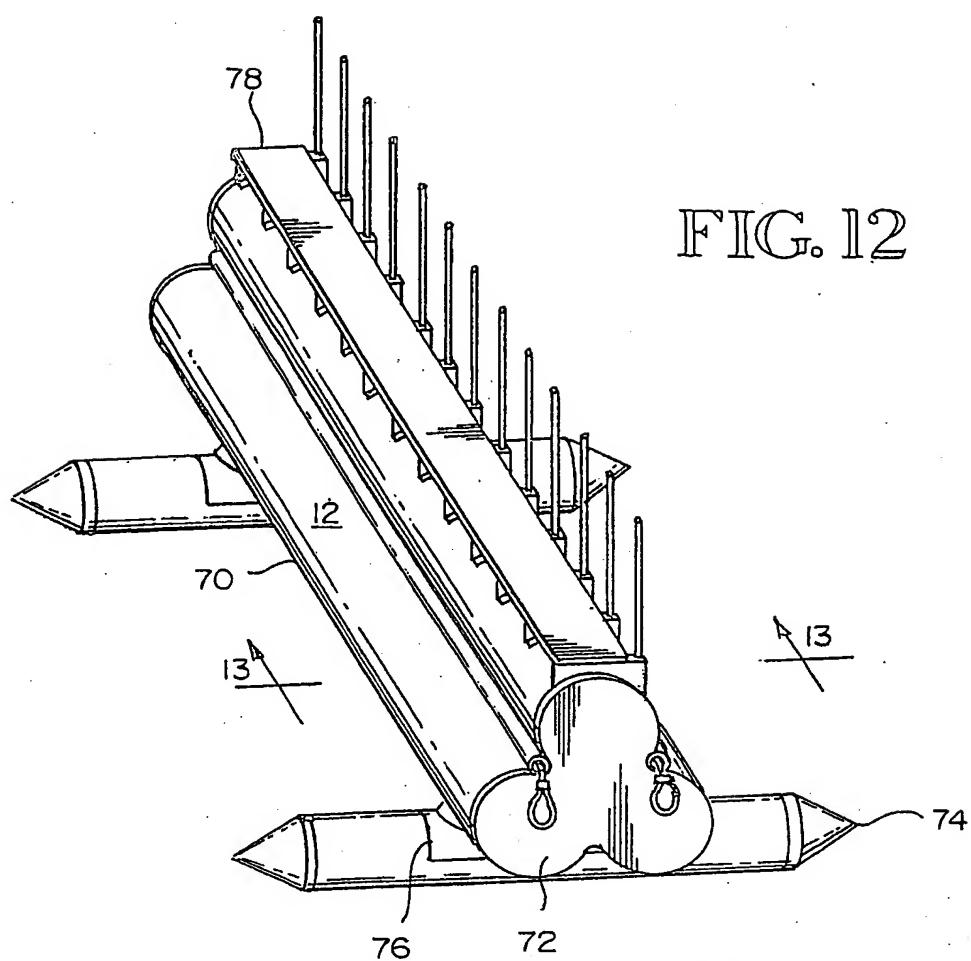


FIG. 12

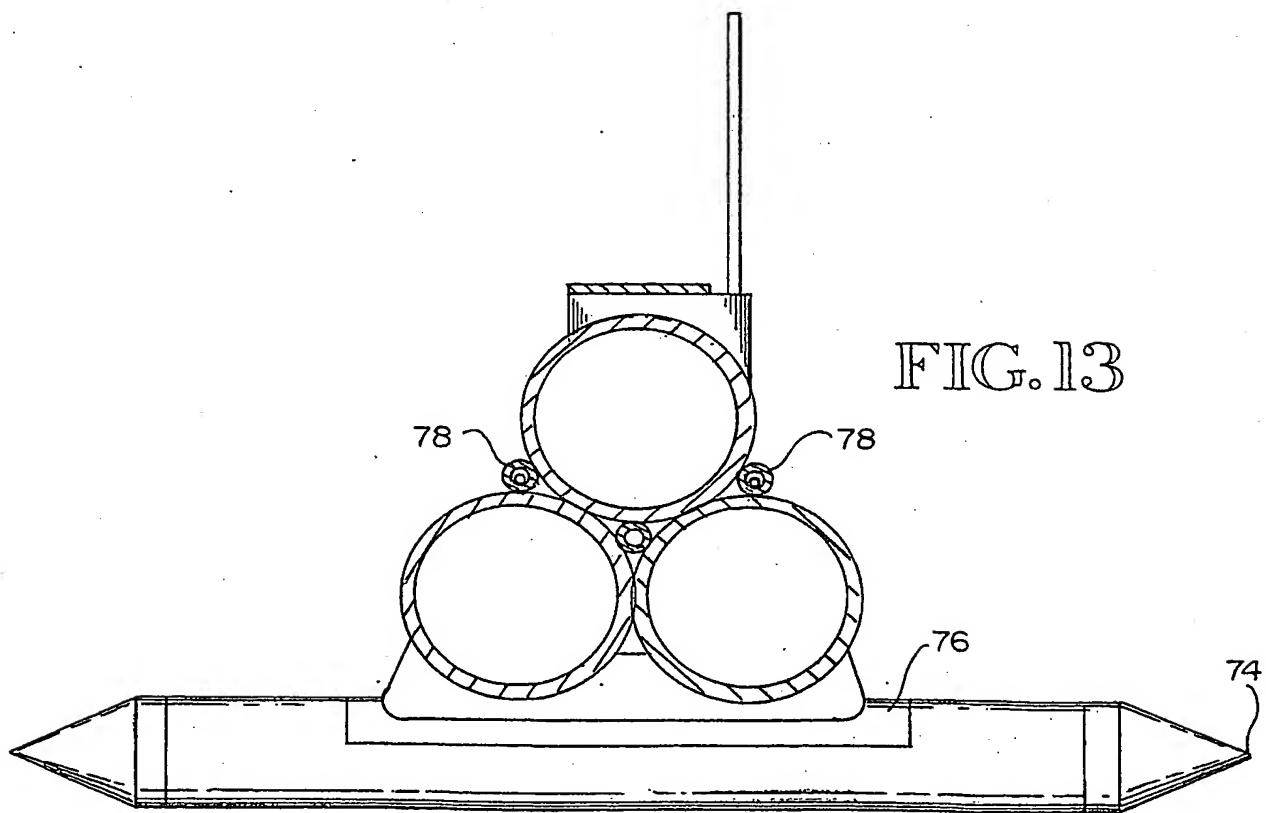
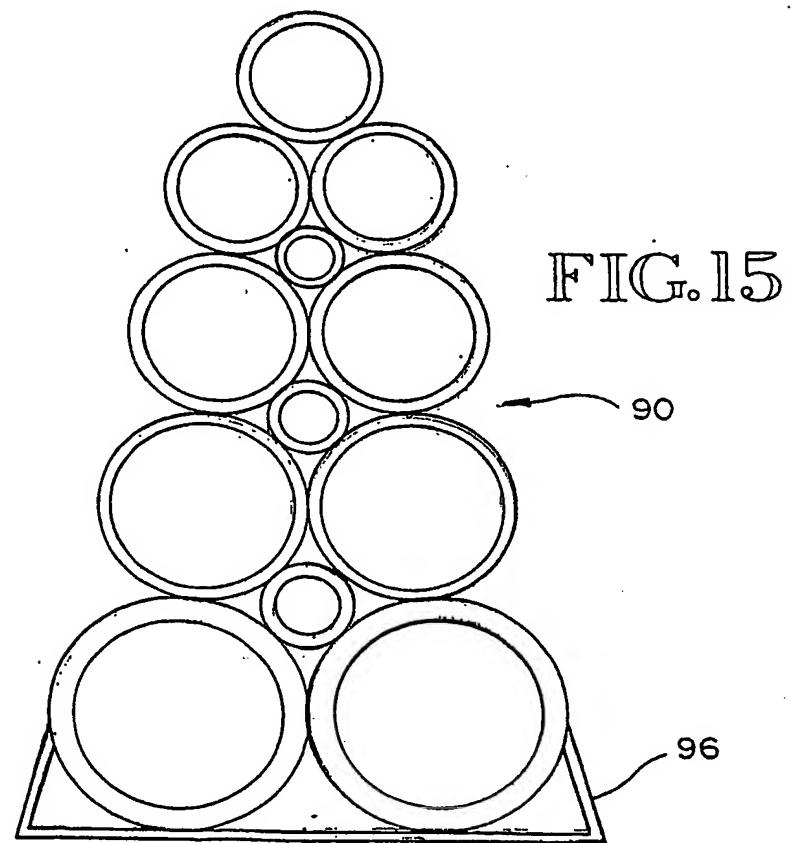
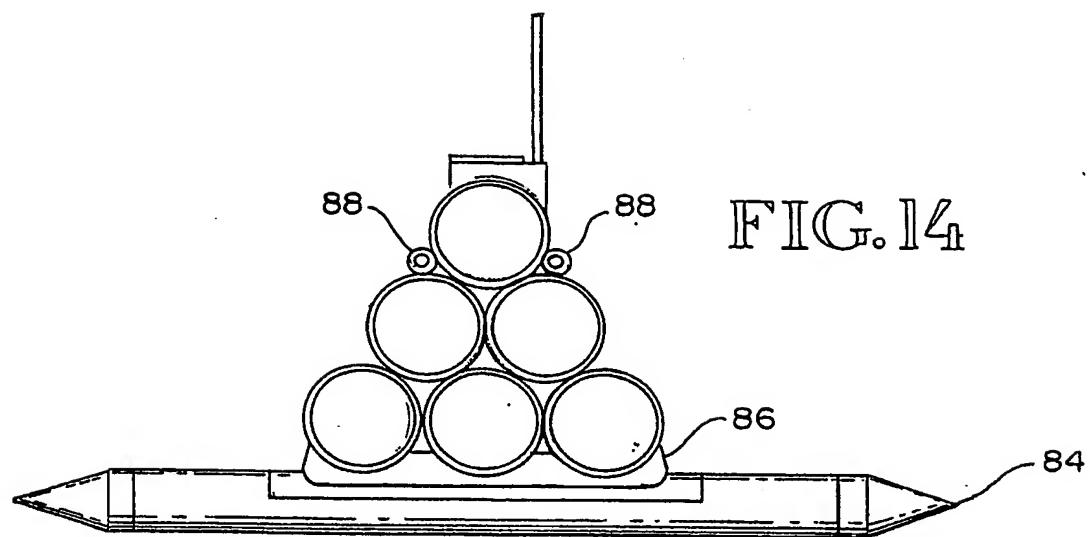


FIG. 13



**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US03/09413

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : B63G 09/02; B63B 43/18, 35/34  
US CL : 405/26,63; 404/6

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
U.S. : 405/26,63,65,66,70; 404/6; 256/1,3,11,13.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,221,884 A (MULLER) 07 December 1965 (07.12.1965), figure 2; column 1 line 59- column 2 line 39.	1-5, 8, 9, 13, 15
Y		17-20
Y	US 3,952,521 A (POTTER) 27 April 1976 (27.04.1976), figures 1 and 2; columns 4-6.	17-20
X	US 3,590,584 A (FITZGERALD et al.) 06 July 1971 (06.07.1971), figure 2.	1-5, 8, 13, 15
Y		17-20
X	FR 2301638 A (GRANGES ESSEM PLAST A/S) 17 September 1976 (17.09.1976), figures 1, 2, and 7..	1-5, 8, 13
Y		15, 17-20
A	US 4,715,744 A (RICHEY) 29 December 1987 (29.12.1987), figures 1, 2, and 4; column 3.	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

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"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X"	document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y"	document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search

01 July 2003 (01.07.2003)

Date of mailing of the international search report

28 APR 2004

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## INTERNATIONAL SEARCH REPORT

## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,567,019 A (HEADRICK) 02 March 1971 (02.03.1971), figures 3A and 3B.	1-20
A	US 6,017,452 A (SCHIWEK) 25 January 2000 (25.01.2000), figures 2-4; column 5.	1-20
A	US 3,958,426 A (HEIEN) 25 May 1976 (25.05.1976), figure 5.	1-20